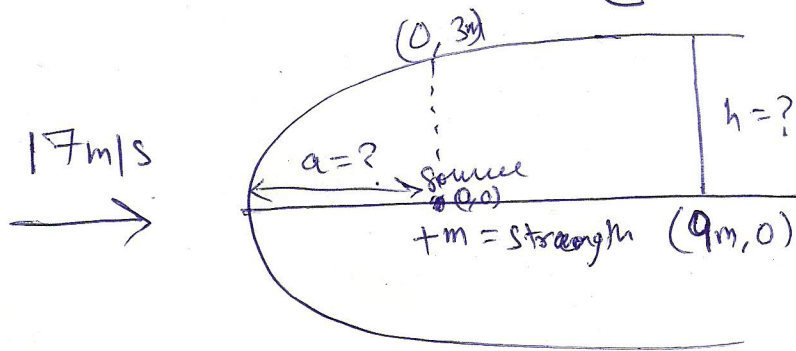


DESIGNED BY
ASHISH GARG

(ASSIGNMENT-2)
POTENTIAL FLOW PROBLEMS (SET-1)
(SET-I)

Q ①



Rankine oval

Find,

$h = ?$

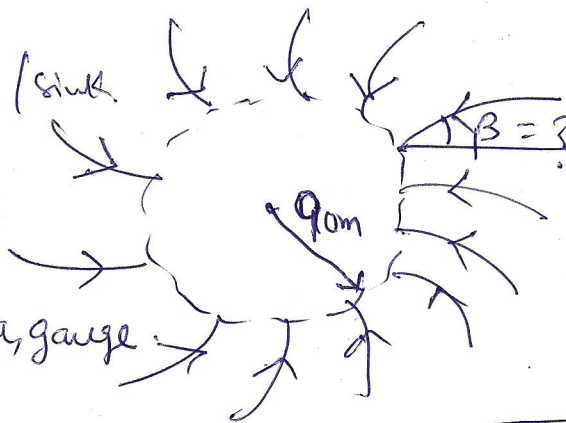
$a = ?$

Q ② Free Vortex / Sink

Given

$\Gamma = 8000 \text{ m}^2/\text{s}$

$P_{r=40\text{m}} = -2300 \text{ Pa, gauge}$



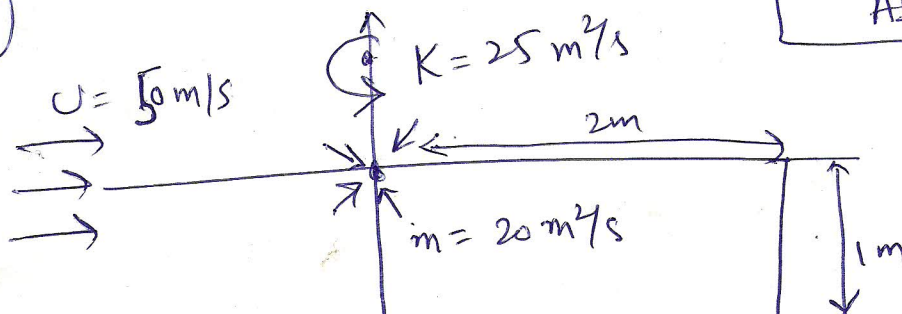
Find,

- (a) Sink strength
- (b) pressure at $r = 15\text{m}$
- (c) angle β .

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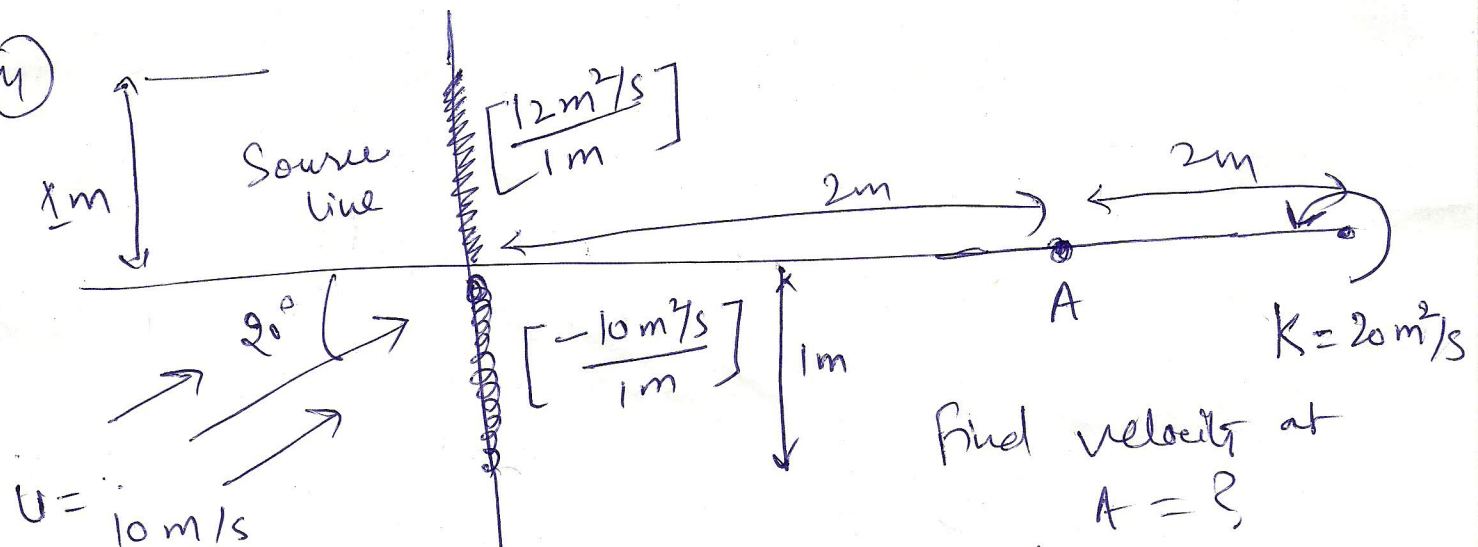
Q ③



Find
velocity at
A = ?

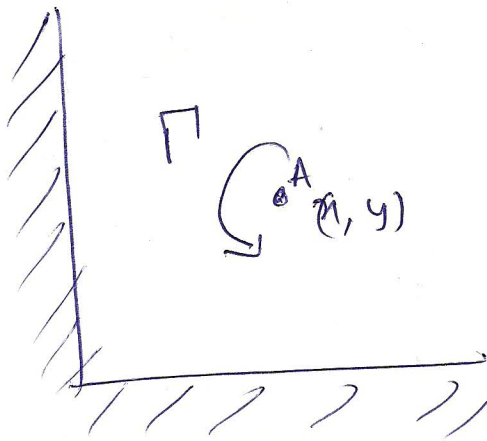
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Q ④



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Q5:-



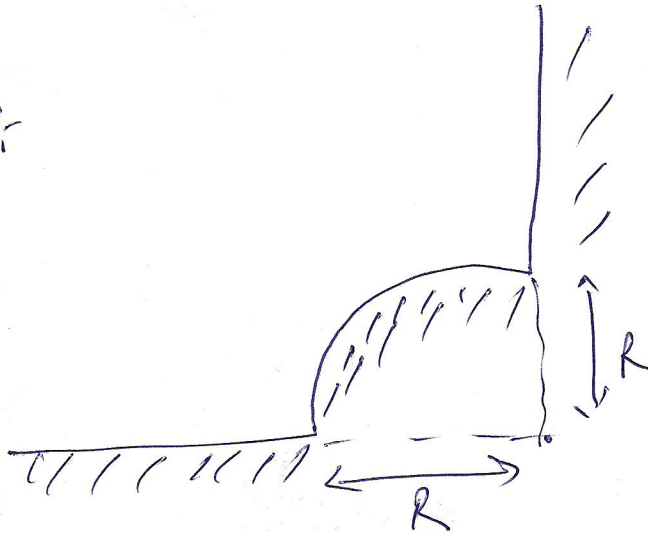
Calculate

velocity at A = ?

in terms of
(x, y)

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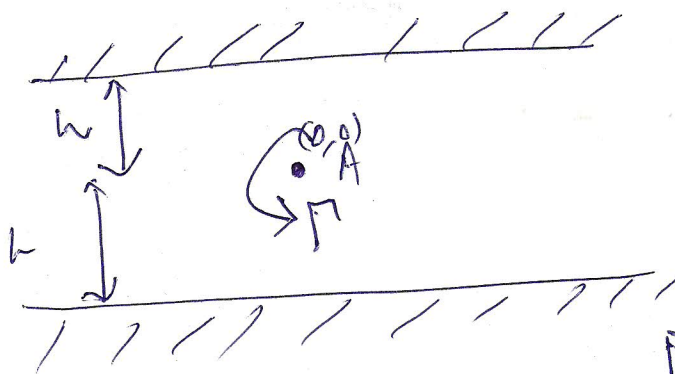
Q6:-



Find Elementary flow
tools to develop this
Kind of solid surface
or streamline

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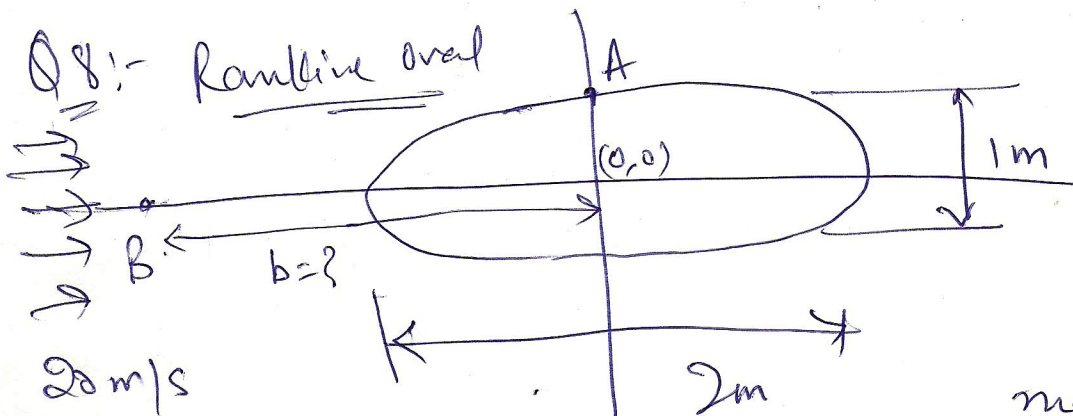
Q7:-



Replace these two
walls and calculate
the flow physics.

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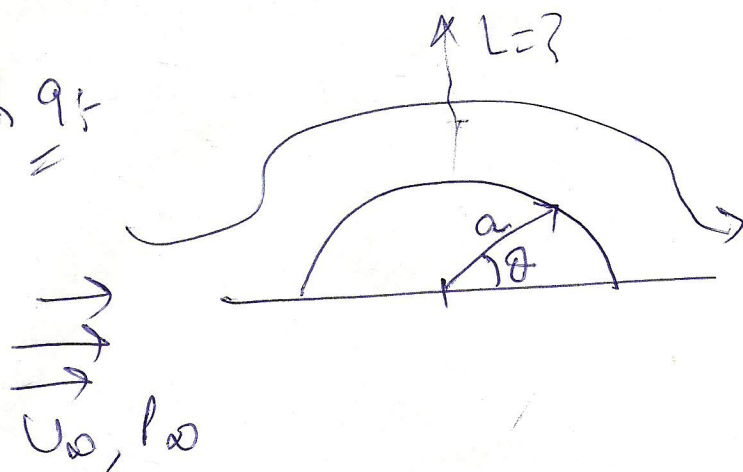
Q8:- Rankine oval



Find velocity at
A,

and $b = ?$ where
point approaches
maximum deceleration

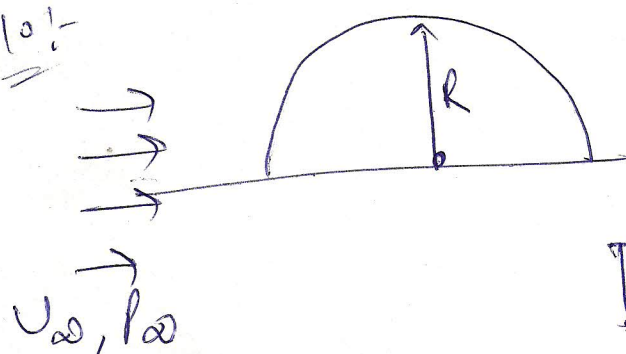
Q 9:-



Calculate lift on half cylinder of 10 m length along depth of this page.

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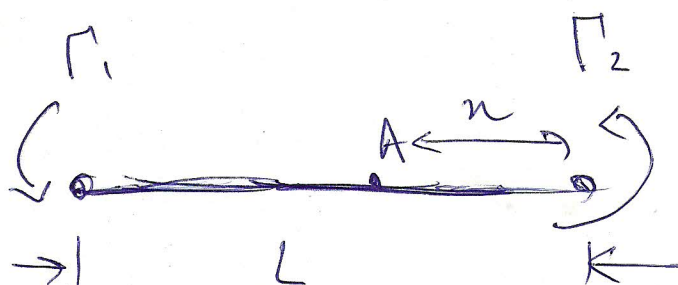
Q 10:-



Calculate lift on ~~sphere~~ hemisphere of radius R,

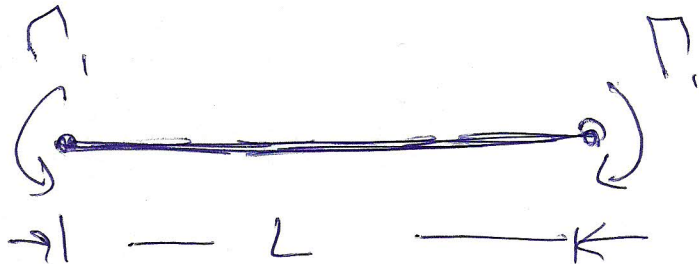
FOUNDER:- ASTHISH GARG

Q 11:-



Find x , where net velocity is zero.

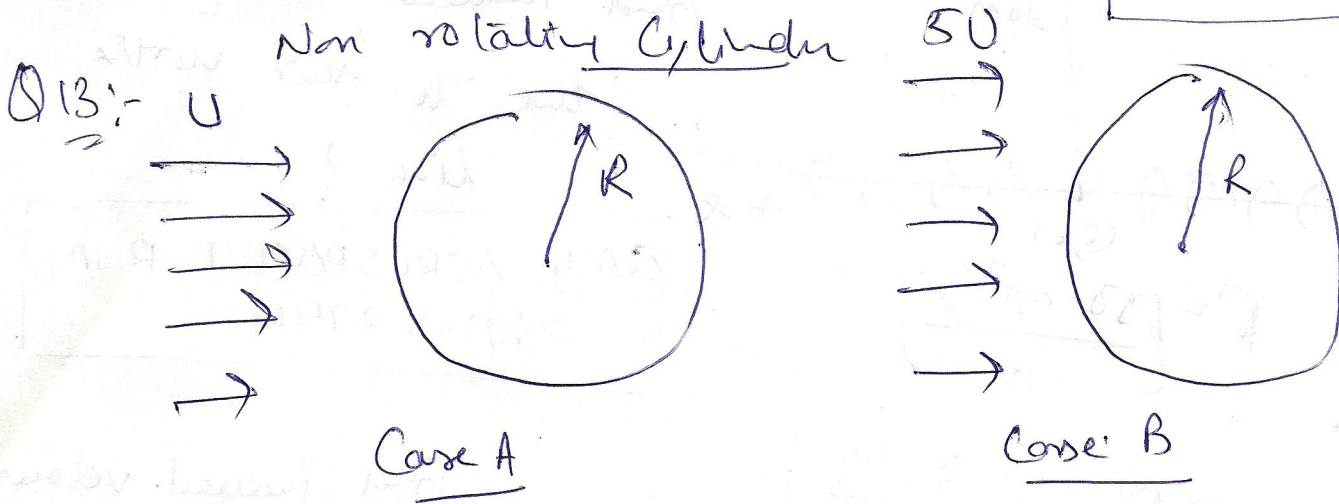
Q 12:-



Find the velocity of rod and direction of motion by

these two circulations

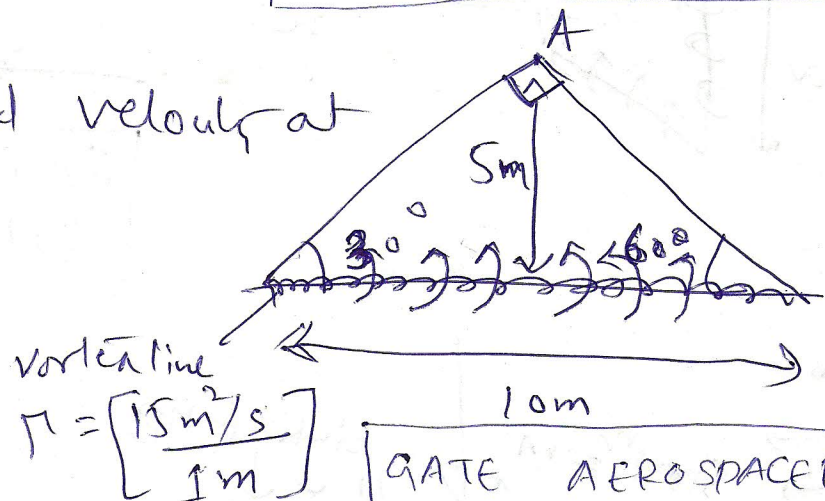
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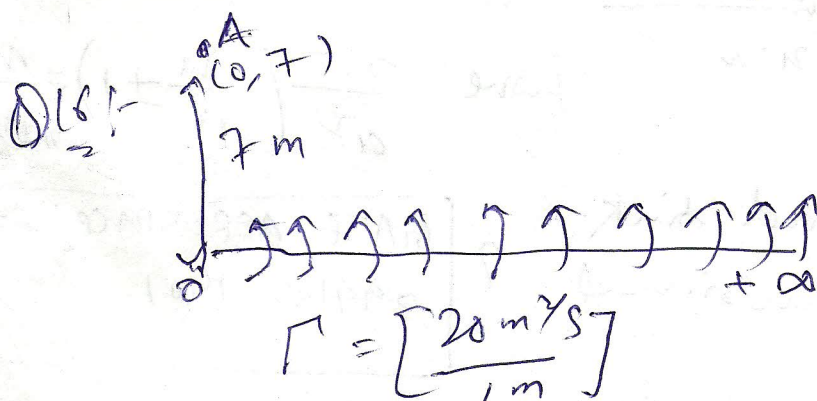
find the stream pattern in both cases, will they same or different for non-rotating cylinder.

Q14:- Do the same analysis for rotating cylinder also.

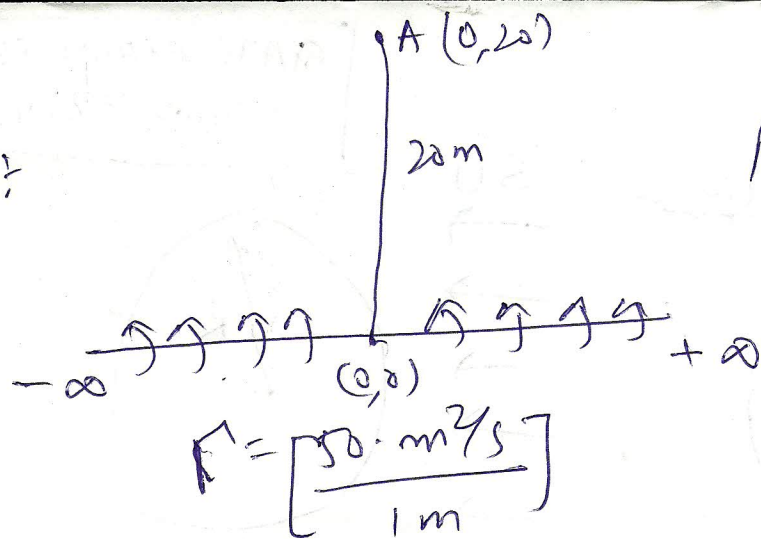
Q15:- find induced velocity at A.



find induced velocity at A?



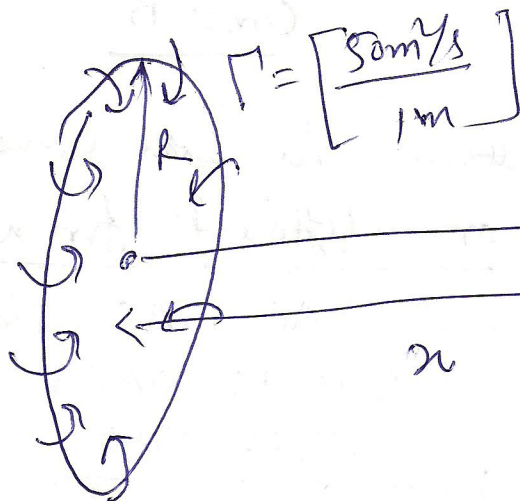
Q17:-



find induced velocity at A due to this vortex line?

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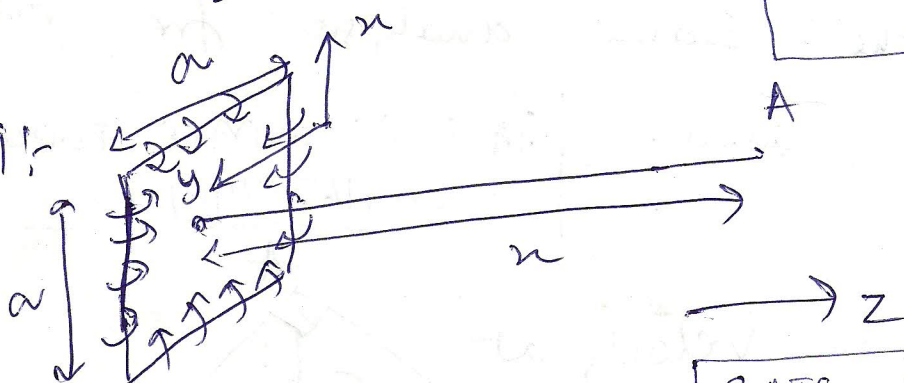
Q18:-



find induced velocity at A by this vortex ring?

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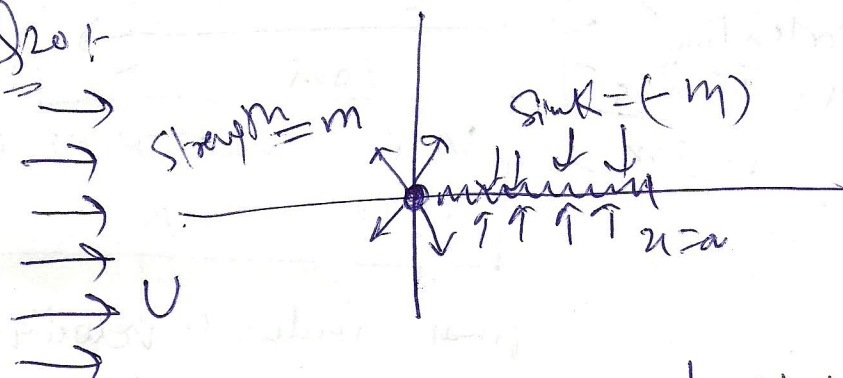
Q19:-



find induced velocity at A by square vortex ring.

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Q20:-



find stagnation point for this case?

$$\text{from } \frac{u^2}{a^2} \left(\frac{u}{a} \pm 1 \right) = \frac{m}{4\pi U a^2}$$

Here source and sink are 3 dimensional?

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Q21 - A solid hemisphere is placed in air with uniform velocity U . Prove that the density of hemisphere material is atleast $\rho_h > \rho \left(1 + \frac{33U^2}{64\gamma g} \right)$ to keep itself ~~fixed~~ fixed at that place?

Assume air density as ρ , and radius of hemisphere as r

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Q22 - For source sink combination of strength m and $-m$ at very small distance at x -axis, $(a, 0)$ and $(-a, 0)$. Prove stagnation point are at $\pm a \left(\frac{m}{a\pi U} + 1 \right)^{1/2}$ if U is uniform velocity at x -axis direction.

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Q23 - Also prove that streamline passing through these stagnation point have $(\psi = 0)$ where ψ is stream function. (linked with problem 22)

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Q24 - ~~Can~~ from Question (22 and 23), Consider this streamline as solid oval shape? find the maximum h for this oval or show that the height will be $h = a \cot \left(\frac{\pi U h}{m} \right)$

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Q25:- Along a vortex line of strength 5 unit the normal velocity component is change $\left[\frac{5 \text{ m/s}}{1 \text{ m}} \right]$

Find the change in vorticity with all direction?

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Q26:- Prof. $u_0 = Kr$, $u_z = 0$, $u_r = 0$ if rotating find the shear stresses at each point? also comment is it viscous (OR) inviscid?

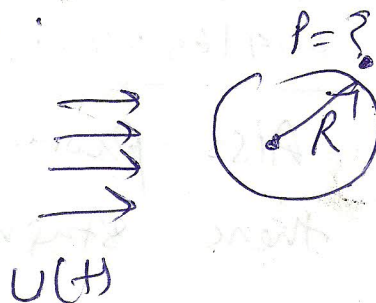
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Q27:- Do the same Q26, Analysis for $u_0 = \frac{K}{r}$, $u_z = 0$, $u_r = 0$?

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Q28:- if uniform velocity is a function of time on the non-rotating cylinder. Find the pressure variation along cylinder as a function of time.

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Q29:- $\phi = \text{potential func} = Ay^3 - Bx^2y$, ($A = \frac{1}{3}$, $B = 1$) find and comment the nature of flow and plot potential line and streamline?

Q30:- Comment on 3-Dimensional Stream Function?

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